

CLAIMS

1. A high strength steel sheet excellent in formability, chemical converted coating treatment and hot-dip galvanizing, characterized in that: said steel sheet contains, in mass,

0.03 to 0.20% C,  
0.005 to 0.3% Si,  
1.0 to 3.1% Mn,  
0.001 to 0.06% P,  
0.001 to 0.01% S,  
0.0005 to 0.01% N,  
0.2 to 1.2% Al, and  
not more than 0.5% Mo,

with the balance consisting of Fe and unavoidable impurities; the amounts of Si and Al in mass % and the target strength (TS) of said steel sheet satisfy the following expression (1); and the metallographic structure of said steel sheet contains ferrite and martensite;

$$(0.0012 \times [\text{target strength TS}] - 0.29 - [\text{Si}]) / 2.45 < \text{Al} < 1.5 - 3 \times [\text{Si}] \dots (1)$$

where, [target strength TS] is the designed strength of said steel sheet in terms of MPa and [Si] is the amount of Si in terms of mass %.

2. A high strength steel sheet according to claim 1, characterized by further containing, in mass, one or more of 0.01 to 0.1% V, 0.01 to 0.1% Ti and 0.005 to 0.05% Nb.

3. A high strength steel sheet according to claim 1 or 2, characterized by: further containing 0.0005 to 0.002 mass % B; and satisfying the following expression (2),

$$500 \times [\text{B}] + [\text{Mn}] + 0.2[\text{Al}] < 2.9 \dots (2)$$

where, [B] is the amount of B, [Mn] that of Mn, and [Al] that of Al, each in terms of mass %.

4. A high strength steel sheet according to any

one of claims 1 to 3, characterized by further containing, in mass, one or both of 0.0005 to 0.005% Ca and 0.0005 to 0.005% REM.

5        5.    A high strength steel sheet excellent in  
formability, chemical converted coating treatment and  
hot-dip galvanizing, characterized in that the ferrite  
grains, wherein the ratio of the breadth to the length of  
each ferrite grain is 0.2 or more, account for not less  
than 50% of the total ferrite grains in said high  
10    strength steel sheet according to any one of claims 1 to  
4.

      6.    A high strength steel sheet according to any  
one of claims 1 to 5, characterized in that said steel  
sheet is a hot-rolled steel sheet or a cold-rolled steel  
15    sheet.

      7.    A high strength steel sheet according to any  
one of claims 1 to 6, characterized in that hot-dip  
galvanizing treatment is applied to said steel sheet.

      8.    A method for producing a high strength steel  
20    sheet according to any one of claims 1 to 7,  
characterized in that said steel sheet is produced  
through the processes of: hot rolling at a finishing  
temperature of the  $A_r$ , transformation temperature or  
higher; coiling at 400°C to 550°C; successively applying  
25    ordinary pickling; thereafter primary cold rolling at a  
reduction ratio of 30 to 70%; then recrystallization  
annealing in a continuous annealing process; and  
successively skin-pass rolling.

      9.    A method for producing a high strength steel  
30    sheet according to claim 8, characterized in that, in  
said annealing process, said steel sheet is: heated to a  
temperature in the range from the  $A_{c1}$  transformation  
temperature to the  $A_{c3}$  transformation temperature +  
100°C; retained for 30 sec. to 30 min.; and thereafter  
35    cooled to a temperature range of 600°C or lower at a  
cooling rate of not less than  $X$  °C/sec.,  $X$  satisfying the  
following expression (3),

$$X \geq (Ac_3 - 500)/10^a \dots (3)$$

$$a = 0.6[C] + 1.4[Mn] + 3.7[Mo] - 0.87,$$

where, X is a cooling rate in terms of °C/sec.,  $Ac_3$  is expressed in terms of °C, [C] is the amount of C, [Mn]

5. that of Mn, and [Mo] that of Mo, each in terms of mass %.